

SAFE, DIRECTIONAL, DROUGHT-RESISTANT DUG WELL (SDDW)

Background. In northern New England, water from private domestic wells often contains naturally occurring contaminants, such as arsenic, at concentrations that exceed US Environmental Protection Agency maximum contaminant levels (MCLs) for drinking water. Some residents who use drilled bedrock wells may find that they require expensive treatment to reduce exposure to arsenic; however, many people do not treat, treat incorrectly, or do not maintain their treatment systems. The shallow glacial aquifer can provide a safe alternate water source, but, traditionally designed dug wells, constructed in these sediments frequently have low yields and are susceptible to bacterial contamination.

Abstract. The present invention is a newly designed shallow well, and has the potential to provide water without high arsenic while also providing high yields and protection from bacterial contamination. The new USGS well design uses a trench filled with crushed stone, constructed in glacial sediment, in which a 6-inch diameter (potable-water grade PVC) well casing with horizontal collectors are installed. The constructed aquifer is capped by an impermeable geotextile fabric and is covered with low-permeability materials to prevent bacterial contamination. The large volume of water that can collect in the constructed aquifer, along with the large vertical area through which groundwater can flow in to the well, provides a much greater well yield than traditional dug wells, while maintaining sanitary conditions. The shallow groundwater, which is generally well oxygenated and slightly acidic, inhibits arsenic mobility and provides clean water to the well.

Opportunity. This new well design is for users who have problematic drilled bedrock wells or existing dug wells. The SDDW is intended to lower the possibility of contamination. The source of the arsenic in ground water of New England is predominantly natural, originating from minerals within the rocks of the region. Former pesticide use, treated lumber, and manufacturing also are sources of arsenic that may contribute to ground-water contamination. In some regions, arsenic concentration of ground water is most likely the result of both

natural processes and human activities. It is estimated that nearly 30 percent of people who have a domestic well in eastern New England could have unhealthy levels of the arsenic in their well water, exposing them to a potential higher risk for cancers, and other health impacts.

About 2.3 million people (about 20% of the total population) in New England obtain water from their own private well. This percentage increases to more than 40% for Vermont, New Hampshire, and Maine. Contaminants, if present in drinking water at elevated levels, can pose a health risk to families.

The quality of water from the seldom-used shallow glacial aquifers that overlie the commonly used bedrock aquifer can provide a reliable, arsenic-free and bacteria-free water supply. This is achieved by using a novel shallow well design that is specifically provides sufficient yield and removes pathways for bacterial contamination. Although developed with New England in mind, this design could be used on many glacial and non-glacial surficial aquifer deposits across the United States as well as internationally.

Keywords

- Glacial aquifer
- Water Quality
- Domestic water well
- Shallow well
- Dug well

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This technology is protected under U.S. patent application 14/488,097. The U.S. Geological Survey is looking for a partner to further the commercialization of this technology through a license or a collaborative agreement. Interested parties should contact:

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